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PATENT
SP01-032

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicant(s):	K. Brundage et al..	Appeal Brief (Amended)
Serial No.:	09/804,944	Group Art Unit: 1725
Filing Date:	March 13, 2001	Examiner: Len Tran
Title:	Substrate Packing For Monolith Reactors	

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Kees van der Sterre

Sir:

This Appeal Brief (Amended) is being filed in support of the Notice of Appeal filed herein on February 24, 2005 and the Notification of Non-Compliant Appeal Brief mailed herein on October 19, 2005. It contains the following sections under the corresponding headings as required by 37 CFR §41.37(c):

Real Party in Interest

The real party in interest in this case is Corning Incorporated, assignee of the entire interest in this application by virtue of an assignment recorded October 1, 2002 at Reel/Frame 011666/0941.

Related Appeals and Interferences

There are no related appeals or interferences

Status of Claims

Claims 1-16.....Rejected
Claims 17-20 .....Canceled

Claims 1-16.....Rejection being appealed

Status of Amendments

Claim 1 (amended) .....Entry refused

Summary of Claimed Subject Matter

The present invention relates to a monolith reactor comprising a plurality of monolithic catalysts disposed in a metal shell or reactor housing. The monolithic catalysts can be, and most typically are, formed of brittle ceramics which have thermal expansion coefficients much lower than the expansion coefficient of the metal shell. A problem arising in the course of operation of such reactors, discovered by the Applicants, is that of breakage or other damage to the monolithic catalysts resulting from that fact that the catalysts and reactor housings are generally constructed of different materials having different thermal expansion characteristics. Thus differential thermal expansion between the housing and the stacks of monolithic catalysts mounted in the housing in use results in changes in mounting pressure that can damage the monoliths. For example, the housing will generally expand more than the monolith stack as the temperature of the reactor is raised to an

operating temperature, leaving the stack loose in the housing and susceptible to breakage from vibration (page 1, lines 23-28 of the specification).

In accordance with the invention, means for supporting the monoliths within the housing under virtually constant compression, regardless of the relative temperatures and dimensions of the housing and the monolith stack, are provided. In exemplary embodiments of the invention illustrated in Figs. 2A and 8B of the drawings and described at page 5, lines 14-16 and page 6, lines 20-22 of the application, spring compression means such as spring-loaded portion 48 and compression spring 66 are provided to apply relatively constant pressure to the monolith stack.

As the Applicants describe (and as the skilled artisan art would recognize from the description), these springs are effective to apply virtually constant pressure to the monolithic honeycomb supports via pressure grids 34 and 58, respectively, thus compensating fully for reactor wall and honeycomb monolith thermal expansion changes. It is by the action of these "means for maintaining said plurality of monoliths under virtually constant compression" (claims 1-16 of the application) that the monoliths in the stack are protected from both excessive pressure and insufficient retaining force as the relative dimensions of the housing and the monoliths change.

Issues To Be Reviewed on Appeal

Whether the Examiner erred in finally rejecting claims 1-4, 10, 11 and 14-16 of the application under 35 U.S.C. §102 as fully met by U. S. Patent No. 4,407,785 (Pfefferle).

Whether the Examiner erred in finally rejecting claims 5 and 6 of the application under 35 U.S.C. §103 as unpatentable over Pfefferle further in view of EP 0 226 306.

Whether the Examiner erred in finally rejection claims 8,9 12 and 13 of the application under 35 U.S.C. §103 as unpatentable over Pfefferle further in view of U.S. Patent No 4,195,064 to Betteken.

Argument

The Examiner's final rejection of claims 1-4, 10, 11 and 14-16 herein under 35 U.S.C. §102 on reference to U. S. Patent No. 4,407,785 (Pfefferle) is clearly in error. Pfefferle discloses a honeycomb reactor wherein the monoliths are retained in an enclosure by means of "intervening spacers" and "retainers". Referring specifically to the disclosure relied on by the Examiner, the spacers are provided to maintain the monoliths in "spaced apart" relationship (column 3, line 60), and the retainers are "fixed" within the enclosure openings (column 3, line 3).

The Examiner has concluded from this disclosure that the retainers are "urged against" the monoliths. However, neither the patent excerpts specifically relied upon by the Examiner, nor any other teachings provided in the Pfefferle patent, appear to teach or suggest the application of any mounting or compression force whatever against the monoliths mounted in the Pfefferle enclosure. Thus no basis for the Examiner's conclusion that the retainers apply urging forces against the monoliths can be found.

Moreover, even if for the purpose of argument the Examiner's conclusion is accepted, it is clear that the Pfefferle retainers are "fixed" with respect to the reactor housing. Accordingly, whatever initial monolith mounting conditions are provided, it is evident that any differential among the thermal expansions of the various reactor and enclosure components in use will immediately result in substantial dimensional changes, and therefore changes in any initial compression that the Examiner may speculate is present in the Pfefferle reactor. No mechanism for maintaining the monoliths under virtually constant compression under such circumstances is taught or suggested. In contrast, significant changes in monolith mounting compression do not occur in accordance with the invention, since the Applicants' constant pressure means effectively "prevent vibration and compensate for different expansions between the monoliths and reactor housing" (original claims 13 and 15 of the application)

In summary, the clear differences between the Applicants' invention and the Pfefferle reactor with respect to essential elements of the rejected claims establish clear error in the rejection of claims 1-4, 10, 11 and 14-16

herein under 35 U.S.C. §102 on reference to Pfefferle. Accordingly, reversal of that rejection by the Board, and the return of this application to the Examiner for further consideration of the claims, are respectfully requested.

The Examiner's rejection of claims 5 and 6 of the application under 35 U.S.C. §103 as unpatentable over Pfefferle further in view of EP 0 226 306 (EP '306) is also in error and should be reversed.

The Examiner cited EP '306 to address the failure of Pfefferle to disclose individual monoliths cemented at their edges. However, contrary to the concept of cementing monoliths together as disclosed by the Applicants, EP '306 teaches that the individual honeycomb monolith units must be capable of sufficient movement relative to one another within the reactor that thermal expansion or contraction of the units can be accommodated (page 2, lines 40-42 of the reference). The disclosure concerning cementing at page 4, line 20 of the reference refers only to the cementing of projecting ceramic block interlocks (10,11) into vertical grooves (9) in each of the honeycomb monolith units (1-5), these units then making up an unbonded layer of honeycomb monoliths such as disclosed in Figs. 1-3 of EP '306.

The fact that the honeycomb monoliths of the reference are not bonded together but instead free to move with respect to each other is shown by the increased separation of the honeycombs from each other as the reactor vessel sidewalls (6) expand away from the honeycomb layer during the heating of the reactor to its operating temperature (page 4, lines 27-41 of EP '306).

It is therefore evident that the combination of EP '306 and Pfefferle fails entirely to teach or suggest the subject matter of claims 5 and 6 of the application. Accordingly, the Examiner's rejection of claims 5 and 6 of the application under 35 U.S.C. §103 as unpatentable over Pfefferle taken with EP '306 should be reversed.

The Examiner also erred in rejecting claims 8, 9, 12 and 13 of the application under 35 U.S.C. §103 as unpatentable over Pfefferle taken with U.S. Patent No. 4,195,064 (Betteken).

The Examiner cited Betteken to address the failure of Pfefferle to disclose monolith support means including a support grating with support rods

extending from the upper stack to the lower stack. However, the catalyst beds of Betteken appear to comprise granulated or pelletized catalysts rather than honeycomb monoliths. Accordingly, Betteken, like Pfefferle, fails to teach or suggest a support grating having a grate pattern similar to junctures between cemented monoliths (Applicants' claim 8), and further fails to show support rods extending through aligned openings in honeycomb monoliths with a bottom plate engaging the lowermost monoliths (Applicants' claim 9).

Equally apparent is the failure of Pfefferle and Betteken to disclose grates with compression means mounted to apply constant force to honeycomb monolith stacks (Applicants' claim 12), and similar force-applying grates with compression means that include rods extending through such stacks (Applicants' claim 13). Clearly, in the absence of any disclosure or suggestion to provide grates, support rods and compression means as required by rejected claims 8, 9, 12 and 13, it is obvious that the subject matter of those claims is neither taught nor suggested by the combination of Pfefferle and Betteken. Accordingly, the rejection of claims 8, 9, 12 and 13 under 35 U.S.C. §103 on reference to Pfefferle and Betteken constitutes reversible error, and that rejection should be reversed.

For all of the foregoing reasons the Applicants respectfully submit that all of remaining claims 1-16 of this application are clearly patentable over the references relied on by the Examiner, and should have been allowed. Accordingly reversal of the Examiner's Final Rejection of claims 1-16 of this application is respectfully requested.

Applicants believe that no extension of time is necessary to make this Appeal Brief [Amended] timely, but contingently request that the Office grant such time extension pursuant to 37 C.F.R. § 1.136(a) as is necessary to make this Reply timely, if in fact such an extension is required. In that contingency

the Office is hereby authorized to charge any necessary extension fee or surcharge to the deposit account of Corning Incorporated, Deposit Account 03-3325.

Respectfully submitted,

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Claims Appendix

[Claims to be reviewed on appeal]

1. A monolith reactor comprising:

   a reactor housing,

   a plurality of monoliths positioned within said reactor housing,

   means for supporting said monoliths within said housing, and

   means for maintaining said plurality of monoliths under virtually constant compression.

2. A monolith reactor as defined in claim 1 wherein said plurality of monoliths is positioned within said reactor housing along a longitudinal axis of said housing.

3. A monolith reactor as defined in claim 1 wherein longitudinal end portions of adjacent ones of said plurality of monoliths are in contact with each other.

4. A monolith reactor as defined in claim 1 wherein said plurality of monoliths are stacked one upon another within said housing.

5. A monolith reactor as defined in claim 4 wherein each of said plurality of stacked monoliths is in the form of an assembly of individual monoliths cemented together about their longitudinal edges forming junctures between the monoliths.

6. A monolith reactor as defined in claim 5 wherein each assembly of monoliths is rotated up to about 90 degrees about a longitudinal axis of the reactor housing with respect to an adjacent assembly in the stack , or the honeycomb channels of the assembly are offset from the adjacent assembly, so as to provide a zigzag flow path through the reactor.

7. A monolith reactor as defined in claim 1 wherein said monoliths are in the form of ceramic honeycomb structures having channels extending there through parallel to a longitudinal axis of said reactor housing.

8. A monolith reactor as defined in claim 5 wherein said support means includes a support grating positioned at the bottom of said stack of monoliths, and having a grate pattern similar to the junctures between the cemented monoliths.

9. A monolith reactor as defined in claim 4 wherein each of said plurality of stacked monoliths has an opening formed therein aligned with its adjacent monolith, and said support means includes a rod having a bottom plate and suspended from an upper portion of said housing, and said rod extending through said aligned openings with the bottom plate engaging the lowermost monolith to support the stacked monoliths.

10. A monolith reactor as defined in claim 1 wherein said plurality of monoliths are stacked within said housing, said means for supporting said monoliths includes at least one support member at a bottom portion of said stack, and said constant compression means includes spring compression means urged against an upper portion of said stack of monoliths.

11. A monolith reactor as defined in claim 10 wherein said spring compression means includes adjustment means for adjusting the amount of pressure applied to the monoliths within said stack between said support member and the upper portion of said stack by said spring means.

12. A monolith reactor as defined in claim 11 including a grate member positioned over the uppermost monolith in said stack, said compression means including a spring member in contact with said

grate member, and said adjustment means including threaded means adjacent said spring member for providing a predetermined pressure to said grate member and for maintaining said stack of monoliths under constant compression to prevent deleterious vibration, pressure and temperature effects on the monoliths.

13. A monolith reactor as defined in claim 10 wherein at least one rod means, threaded at an upper end portion, extends through said stack of monoliths and secured at it upper end within said housing, said support member secured to the bottom of said rod means and supporting the bottom monolith in said stack, a pressure grid positioned over the uppermost monolith in said stack, said spring means overlying said threaded rod portion, and adjustment means on said rod means for maintaining said stack of monoliths under a constant predetermined compression to prevent deleterious vibration and compensate for different expansions between the stacked monoliths and reactor housing.

14. A monolith reactor as defined in claim 5 wherein cross-like spacers are provided between adjoining monolith assemblies in said stack, and a portion of said spacers being embedded within said adjoining assemblies.

15. A reactor for use in chemical processes comprising:
    a reactor housing,
    a plurality of honeycomb substrates positioned in a stacked relationship within said reactor housing along a longitudinal axis thereof, and
    means for holding said stacked substrates together in a tight relationship for preventing deleterious vibration of the substrates and for compensating for different expansions between the stacked substrates and the reactor housing.

16. A reactor for use in chemical processes as defined in claim 15 wherein said means for holding said honeycomb structures tightly together includes spring compression means for maintaining a virtually constant predetermined compression on said stack of substrates.